BACK PAPER ODD/EVEN SEMESTER/ANNUAL EXAMINATION, JULY-2026

Course Name: B.Tech. Semester: IInd

Paper Name: Engineering Mathematics Paper Code: NBS-202

Time: 3 Hrs. + 20 Minutes per hour extra time for V.I. and examinees with writer. Max. Marks: 70

समय - 3 घण्टे + 20 मिनट प्रति घण्टे अतिरिक्त दृष्टिबाधित एवं सहलेखक परीक्षार्थियों के लिए। अधिकतम अंक: 70

Instructions:

(i) The question paper consists of three Sections namely A, B and C. All Sections are compulsory.

(ii) Section-A – Each question carries 3 marks. All questions are compulsory.

(iii) Section-B – Answer any 5 out of 7 given questions. Each question carries 07 marks.

(iv) Section-C – Answer any 2 out of 3 given questions. Each question carries 10 marks.

निर्देश:

(i) प्रश्न-पत्र में तीन खण्ड अ, ब व स हैं। सभी खण्ड अनिवार्य हैं।

(ii) खण्ड-अ में प्रत्येक प्रश्न 03 अंकों का है। सभी प्रश्न अनिवार्य हैं।

(iii) खण्ड-ब में 07 प्रश्नों में से किन्हीं 05 प्रश्नों के उत्तर दीजिये। प्रत्येक प्रश्न 07 अंकों का है।

(iv) खण्ड-स में 03 प्रश्नों में से किन्हीं 02 प्रश्नों के उत्तर दीजिये। प्रत्येक प्रश्न 10 अंकों का है।

Section-A (खण्ड-अ)

Objective Questions (वस्तुनिष्ठ प्रश्न)

1. Answer all the following questions: (3×5=15)

निम्नलिखित सभी प्रश्न अनिवार्य हैं:

(i) The value of div $L[t^5 e^{3t}]$ is:

(A) $\frac{L5}{(s-3)^6}$ (B) $\frac{L5}{(s-3)^5}$

(C) $\frac{L4}{s^4}$ (D) $\frac{L3}{s^3}$

(ii) Th partial differential equation $\frac{2\partial^2 U}{\partial x^2}+\frac{4\partial^2 U}{\partial x \partial y}+\frac{6\partial^2 U}{\partial y^2}=0$ is:

(A) Elliptic (B) Parabolic

(C) Hyperbolic (D) NOT

(iii) The value of $P_n(-1)$ is:

(A) 1 (B) –

(C) $(-1)^n$ (D) $(-1)^{n/2}$

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(iv) The solution of $xp + yq = z$ is:

(A) $f\left(x^2, y^2\right) = 0$

(B) $f(x, y) = 0$

(C) $f[x/y, y/z] = 0$

(D) $f[xy, yz] = 0$

(v) If $LF(t) = f(s)$ and $G(t) = \begin{cases} e^{2(t-4)}, & t > 4 \\ 0 & t < 4 \end{cases}$. Then the value of $L[G(t)]$ is:

(A) $\dfrac{e^{-4s}}{(s-2)}$

(B) $\dfrac{e^{4s}}{(s-2)}$

(C) e^{-4s}

(D) e^{4s}

Section-B (खण्ड-ब)

Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions: (7×5=35)

निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर दीजिये:

(i) Solve $\dfrac{\partial U}{\partial x} = 3\dfrac{\partial U}{\partial t}$ using method of separation of variables.

(ii) Solve the partial differential equation $x\left(y^2 + z\right)p - y\left(x^2 - z\right)q = z\left(x^2 - y^2\right)$ where $p = \dfrac{\partial z}{\partial x}$, $q = \dfrac{\partial z}{\partial y}$.

(iii) Using the convolution theorem find $L^{-1}\left[\dfrac{s^2}{\left(s^2+36\right)\left(s^2+49\right)}\right]$.

(iv) Find the Fourier transform of $f(x) = \begin{cases} x & \text{if } |x| \le a \\ 0 & \text{if } |x| > a \end{cases}$.

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(v) Explain in terms of Legendre polynomials:

(a) $1 + x + x^2$

(b) $4x^3 - 3x^2 + 2x + 1$

(vi) Find $F(x)$ if its finite Fourier sine transform is given by:

(a) $f_s(s) = \frac{1 - \cos s\pi}{s^2\pi^2}$ for $s = 1, 2, 3$ ..... and $0 < x < \pi$

(b) $f_s(s) = \frac{\cos 2\pi\ s/3}{(2s+1)^2}$ for $s = 1, 2, 3$ ..... $0 < x < 1$

(vii) Solve the partial differential equation $\left(D^3 - 7DD'^3\right)Z = \sin(x + 2y) + e^{2x+y}$.

Section-C (खण्ड-स)

Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following questions: *(10×2=20)*

निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर दीजिये:

(i) Find the Fourier series expansion for:

$$f(x) = x + \frac{x^2}{4}, \quad -\pi \le x \le \pi$$

Or

Find a complete integral of $zpq = p + q$ by using Chapit's method.

(ii) Prove that:

(a) $xJ_n'(x) = nJ_n(x) - xJ_{n-1}(x)$

(b) $P_n'(x) - xP_{n-1}' = nP_{n-1}$

(iii) Solve the simultaneous equations by Laplace method:

$$x\left(y^2 + z\right)p - y\left(x^2 + z\right)q = z\left(z^2 - y^2\right) \text{ where } p = \frac{\partial z}{\partial x},\ q = \frac{\partial z}{\partial y}$$

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